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Phycological studies—V. Some marine algae of Lower California, Mexico

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(WITH PLATES 27–34)

So far as the writer is aware, the only paper in which the algae of Lower California (Baja California) have been described or noted is one by M. Paul Hariot, published in 1895.* In that paper seven species, five marine and two from fresh water, were recorded; of the seven, three were described as new. In our list published below, twenty-four species are definitely named and three others have been referred simply to genera, and as these are all different from the seven recorded by M. Hariot, we have now, for the beginnings of our knowledge of the algal flora of Lower California, some evidence of the existence there of at least thirty-four species. The fact that none of the collections thus far made duplicates any of the others even as to a single species may possibly be taken as an indication that the algal flora of this region, when better known, may prove to be rich and varied. The present paper is based primarily on a collection made at La Paz on February 28, 1911, by Señor G. J. Vives, and submitted to the writer for determination by the late Dr. Pehr Olsson-Seffer, chief of the botanical section of the Departamento de Exploración Biológica of the agricultural bureau of the Mexican government. Señor Vives' collection includes eighteen species, of which seven are described below as new. In addition to this gathering, a collection of six

* Algues du Golfe de Californie recueillies par M. Diguet. Journal de Botanique 9: 167–170. 1895.

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species made in February, 1904, by Dr. D. T. MacDougal, in San Felipe Bay, 500 miles or more north of La Paz and near the head of the Gulf of California, is reported upon; of these we have ventured to propose one species as new. In the list are included also three other species from La Paz, which came to the herbarium of the New York Botanical Garden in 1904 through the purchase of the herbarium of Dr. C. L. Anderson, of Santa Cruz, California.

CHLOROPHYCEAE

ULVA FASCIATA Delile, Fl. Égypte 153. *pl. 58. f. 5*

La Paz, *Vives 12* and *24*.

The specimens appear to approach Setchell's forma *expansa*. The thallus is only 35–55μ thick and the cells in the older parts are often subquadrate in cross section, but in these respects the plants do not differ much from the New York Botanical Garden copy of Phyc. Bor.-Am. LXXVII, distributed as *Ulva fasciata* forma *expansa* Setchell.

ULVA LACTUCA RIGIDA (Ag.) Le Jolis, Liste Alg. Mar. Cherbourg 38. 1863

Ulva rigida Ag. Sp. Alg. 410. 1822.

San Felipe Bay, *D. T. MacDougal*, Feb. 1904.

Thallus 36–42μ thick, brownish, becoming almost livid.

(?) ENTEROMORPHA INTESTINALIS (L.) Grev. Alg. Brit. LXVI, 179. 1830

La Paz, *Vives 16*.

Inconspicuously proliferous near base, the proliferations often short and spinescent; membrane 40–54μ thick; cells mostly 13–25μ in diameter, rather thin-walled, in cross section of thallus about 40μ long, exclusive of outer walls; attached to the stalks of a Sertularian (?) animal.

ENTEROMORPHA LINZA (L.) J. Ag. Till Alg. Syst. 3: 134. 1882

Ulva Linza L. Sp. Pl. 1163. 1753.

San Felipe Bay, *D. T. MacDougal*, Feb. 1904.

The plants are small and unusually narrow (4–10 cm. long, 1–6 mm. wide) and their margins are plane or nearly so. They

are rather difficult to distinguish from *Enteromorpha compressa* forma *simplex* Wittr. & Nordst. (Alg. Exsicc. *326*), but the two layers of the thallus appear to separate less easily in the upper broader parts, the marginal cells in a cross section are more elongate and more radiately disposed, and the cells in general are more distinctly in lines in the lower parts. No trace of branching has been observed.

Cladophora MacDougalii sp. nov.

Rather stout, coarse, and rigid, in strict tufts, dark- or yellowish-green, 10–17 cm. high; main filaments 135–310μ in diameter, sparingly dichotomous below the middle of the tufts; branching in median and upper parts lateral, the branches erecto-patent, secund, occasionally alternate, or very rarely opposite, becoming more or less secund-pectinate toward apices, the main axes commonly excurrent beyond the last lateral branch as rather rigid tapering prolongations 10–40 cells long; the ultimate lateral branchlets 75–110μ in diameter, about one half the diameter of the filaments from which they spring, usually 3–7 cells long, in most cases gradually tapering from near the base, subacute or blunt, commonly rather rigid; cells in extreme basal parts 6–15 times as long as broad, in median and upper parts 1–4 (mostly 1½–2½) times as long as broad, usually a little constricted at the septa and appearing quite strongly constricted when dry. [PLATE 33, FIGURE 7.]

San Felipe Bay, *D. T. MacDougal*, Feb. 1904.

The present species is evidently allied to both *Cladophora Hutchinsiae* (Dillw.) Kütz. and to *C. ovoidea* Kützing, but is not satisfactorily identified with either. In size it resembles *C. Hutchinsiae* (type from Ireland), but it is more rigid and much more strict in habit of growth; dichotomies are rare above the middle of the tuft, while in *C. Hutchinsiae* they commonly persist almost to the apices; the ultimate lateral branchlets in *C. MacDougalii* are much more slender than the axes from which they arise, having usually, in their middle parts at least, only half the diameter of the parent filament, while in *C. Hutchinsiae* the corresponding branchlets are as a rule only slightly less stout than the filament from which they spring; in *C. MacDougalii* ultimate lateral branchlets of 1 or 2 cells in length are extremely rare, 5 to 7 cells being the prevailing number, while in *C. Hutchinsiae* branchlets of 1 or 2 cells are very common.

Cladophora ovoidea Kütz. (type from the island of Föhr, North Sea) has, according to its original describer, primary filaments that are 1/20‴ (112μ) thick and upper branches 1/40‴ (56μ) thick,* and his later† figures of the species bear out this general description of its dimensions, though one of the cells of the main filament figured, according to the magnification given, reaches a diameter of 150μ. We have seen no European specimens of *C. ovoidea*, but are unwilling at the present time to identify with this species a Lower California plant with filaments and branches averaging twice as thick as those of the plant described and figured by Kützing, and with filaments so little constricted at the septa (in a soaked-out condition, at least) that no one would think of describing any of the cells as "ovoid" (Kützing, Phyc. Gen. 266). Also, according to Kützing's figure, the branching in *C. ovoidea* is more fasciculate than in *C. MacDougalii*, the ultimate lateral branchlets are less tapering and less rigid, and the main axes do not show the long-excurrent prolongations of the Baja California species.

CLADOPHORA TRICHOTOMA (Ag.) Kütz. Sp. Alg. 414. 1849

Conferva trichotoma Ag. Syst. Alg. 121. 1824.

Fragments referable to this or to some closely allied species are mixed in with a specimen of *Centroceras clavulatum* from La Paz in the herbarium of the New York Botanical Garden, ex herb. C. L. Anderson, collector unknown. The intertangled filaments are 190–300μ in diameter, di- or trichotomous at nearly every joint, with occasional short and blunt lateral branches 1–3 cells long and of scarcely less diameter than the parent filament; cells mostly 2–5 times as long as broad, usually constricted at the septa, the upper often ovoid. The plants are rather coarser and the cells are relatively shorter than called for by Kützing's description and figures for the species in question.

HALIMEDA DISCOIDEA Decaisne, Ann. Sci. Nat. II. **18**: 102. 1842.
Howe, Bull. Torrey Club **34**: 495–500. *pl. 25. f. 11–20; pl. 26.* 1907

La Paz, *Vives 4*.

The segments are here mostly quadrangular-oblong or cuneate-

* Kützing, Sp. Alg. 393. 1849.

† Kützing, Tab. Phyc. **3**: 26. *pl. 92. f. 1.* 1853.

obovoid, the longer axis being nearly always in the longitudinal or vertical plane rather than in the transverse. As in Hawaiian specimens, the utricles of the subcortial layer are smaller and less bullate than in the plants of southern Florida and the West Indies, but they have a maximum diameter of 68–175μ and are always much larger than the peripheral utricles; they also form a compact flat-topped stratum, very different from anything that occurs in *H. Tuna*. The firmly coherent, often interlocked and fusing peripheral utricles, and the light calcification, together with the characters previously mentioned, leave no doubt as to the correctness of identifying the plants with *H. discoidea*.

The finding of a *Halimeda* on the coast of Lower California is of particular interest in extending our knowledge of the distribution of this genus. So far as is known to the writer, the only previous record of the occurrence of a *Halimeda* on the Pacific coast of the American continents is that given by Miss Ethel Sarel Barton [Mrs. Gepp] in her monograph of "The Genus *Halimeda*," where, under the stations for *Halimeda Tuna*, is given "Payta, Peru, *Sinclair*."

CODIUM TOMENTOSUM (Huds.) Stackh. Ner. Brit. XXIV. 1797

Fucus tomentosus Huds. Fl. Angl. 584. 1778.

La Paz, *Vives 8* and *14*.

The specimens from Baja California communicated under the above numbers are a little more rigid than is usual in *Codium tomentosum*, and the walls of the peripheral utricles are for the most part conspicuously thickened at their apices, being there commonly 8–27μ thick, though occasionally only 3–4μ. We find no trace of a mucro even in the younger parts and can discover no sufficient ground for considering the plants distinct from *C. tomentosum*, with which they agree well in size and habit. The thickened apices of the utricles are slightly suggestive of those of the Australian *Codium galeatum* J. Ag., but they are not contracted-umbonate as in that species and the plants have not the size and habit of that species. Certain Jamaican specimens which we have referred to *C. tomentosum*, sometimes have the apical walls of the peripheral utricles even more thickened than in these plants from Lower California, and European specimens occasion-

ally show the same character. In this latter connection may be mentioned especially Hohenacker's Meeralgen, *no. 497*, from Cherbourg, distributed as *Codium tomentosum* var. *proliferum*, and *no. 35* of Mary Wyatt's Algae Danmonienses. *No. 628* of the Phycotheca Boreali-Americana, from La Jolla, California, issued as *Codium Lindenbergii* Binder, is, so far as we have seen it, a somewhat coarser and less copiously branched plant than those from Baja California, and its peripheral utricles are scarcely thickened at the apex. If it had been collected in England, we suspect that it would have been referred to *Codium tomentosum* without serious question. The plants issued under this number, so far as we have seen them, scarcely show evidence of flattening beyond that resulting from pressure. They are certainly very different in habit from plants of the South African *C. Lindenbergii*, which is conspicuously flattened throughout, with the possible exception of the stipe, and has segments often 2–3 cm. wide. The utricles of the Baja California plants, it may be remarked, are clavate, obovoid-clavate, truncate-clavate, or pestle-shaped, 82–165μ in greatest width, and 380–500μ long.

Codium decorticatum (Woodw.) comb. nov.

Ulva decorticata Woodw. Trans. Linn. Soc. 3: 55. 1797.
Codium elongatum Ag. Sp. Alg. 1: 454. 1822.

La Paz, *Vives 17*.

The plants reach a length of 5 dm., are sparingly branched, and, in the older, are flattened now and then under the dichotomies; the peripheral utricles are obovoid or broadly clavate, thin-walled, obtuse, 137–520μ in maximum width, and 500–700μ long.

The identity of Woodward's *Ulva decorticata* with *Codium elongatum* was admitted by C. Agardh himself at the moment of proposing the name *C. elongatum* and has been acknowledged also by Kützing. We have not seen Woodward's specimen and do not know that it exists, but his lengthy and rather detailed description can leave students of *Codium* in no reasonable doubt as to what he actually had. His failure to recognize its affinity with "*Fucus tomentosus* Huds." and his statement that "in substance it differs from all other known marine Algae" appear a little strange, yet from Goodenough and Woodward's paper on the

British Fuci, published in the same volume of the Transactions, it would seem that these authors were not very familiar personally with "*Fucus tomentosus*" and, furthermore, that they considered it "very doubtful whether it may not belong to the genus *Ulva*." Agardh doubtless thought that he was improving on the specific name in substituting *elongatum* for the inapt and more or less misleading *decorticatum*, but under the prevalent rules of procedure of the present day, there seems to be no sufficient reason for ignoring what is apparently the oldest tenable specific name.

Harvey and some other writers have doubted the specific distinctness of what has been known as *Codium elongatum*, considering it a form of *C. tomentosum*. But in its usual form it is so different from *Codium tomentosum*, and ambiguous conditions are so few that it seems worth while, for the present at least, to maintain its specific rank. Its elongate and sparingly branched habit, its more or less pronounced flattened expansions below the dichotomies, and its larger utricles, are commonly quite sufficient to distinguish it from *C. tomentosum*. In this connection, however, it is of interest to note that the apparently original specimens of *C. elongatum* Ag., preserved in the Agardh herbarium, do not show particularly large utricles (they are 110–225μ in greatest width), and the dilations under the dichotomies are not remarkably pronounced, reaching a width of scarcely 2 cm. In specimens of our collecting in Bermuda the dilations sometimes have a width of 10 cm. or more.

PHAEOPHYCEAE

COLPOMENIA SINUOSA f. TUBERCULATA (Saunders) Setch. & Gard. Univ. California Stud. Bot. 1: 242. 1903

Colpomenia tuberculata Saunders, Proc. California Acad. Sci. III. 1: 164. *pl. 32. f. 1–3.* 1898.

La Paz, collector unknown. The specimens were sent to Dr. C. L. Anderson from the California Academy of Sciences, with the information that they had been used for packing. The brown, coriaceous thallus forms mats 10–20 cm. wide. Some parts of the thallus are nearly smooth, some parts bear wartlike excrescences, and others are drawn up into subconical, bullate, or finger-shaped processes sometimes 1–2 cm. long.

COILODESME ————?

La Paz, *Vives 18c.*

Poor and fragmentary material, but it seems to be closely related to *Coilodesme californica* (Rupr.) Kjellm.

SARGASSUM ————?

La Paz, *Vives 18d.*

A fragment of a plant of the *Eusargassum* section, with thin linear-lanceolate serrate-ciliate leaves 6–8 cm. long and 7–12 mm. in greatest width; cryptostomata inconspicuous or wanting; leaf margins here and there approaching a biserrate condition.

SARGASSUM ————?

La Paz, *Vives 1.*

A single plant a meter or more in length, sterile or with very immature receptacles. Resembling *Vives 18d*, but the lanceolate or linear-lanceolate leaves (2–9 cm. long, 5–14 mm. in greatest width) have much more conspicuous cryptostomata. The texture of the leaves is thin-membranous and the margins are irregularly serrate, the teeth often terminating in soft somewhat cilium-like points. The vesicles are subglobose and muticous, the largest attaining a diameter of 6–8 mm. Both this and 18*d*, which is possibly a form of the same thing, are quite different from *Sargassum Liebmanni* J. Ag. and *S. Agardhianum* Farl., which, so far as we are aware, are the only two species of *Sargassum* that have thus far been described from the Pacific coast of North America. The plants suggest broad-leaved forms of *S. Filipendula* (Ag.) J. Ag., but we are unwilling to refer them to that species and unwilling also, with the material at hand, to propose a new specific name in a genus in which more than two hundred more or less imperfectly understood species have already been proposed.

In the herbarium of the New York Botanical Garden (ex herb. C. L. Anderson) are four fragments of a *Sargassum* from La Paz, Baja California, which have leaves resembling those of *Vives 1* in form, size, margin, and cryptostomata, but are rather more coriaceous. One of the specimens is accompanied by a long (12 cm.) lax leafless panicle of receptacles. The panicle is detached but probably belongs with the accompanying stem and leaves.

PADINA DURVILLAEI Bory, Dict. Class. Hist. Nat. **12**: 591. 1827; Voy. Coquille, Bot. Crypt. 147. *pl. 21. f. 1.* 1828

La Paz, *Vives 5*, *13*, and *15*.

No. 13 of the material communicated consists of one young specimen 5–6 cm. high and one larger, apparently mature but sterile specimen about 12 cm. high, with its main, flabellate or cuneate-flabellate lobes 10–12 cm. broad. The thallus is somewhat coriaceous and multistratose except at the extreme margin; it is for the most part 8–12 cells thick, though towards the base it may become as much as 18 cells thick. Specimens of *P. Durvillaei* in the Muséum d'Histoire Naturelle of Paris, marked "de la Concepcion, Chili, par Durville, 1825, . . . petits individus," show a thickness of 8–10 cells in median portions.

No. 5 is similar to the older plant under no. 13, but is smaller and more dissected. No. 15 consists of fragments distorted by bearing the eggs of some marine animal.

PADINA sp.

La Paz, *Vives 3*.

A much thinner and rather more calcified plant than no. 13 (*P. Durvillaei*). The single specimen gives the impression of having been semiprostrate when growing, though this appearance may be due in part to the way the specimen has been pressed and dried. The plant is 6–7 cm. long or high and its rounded-flabelliform lobes are 6–7 cm. broad. The thallus is 3 cells thick from the base to the rolled margin, which is bistratose. The surface cells are oblong, 22–68μ × 22–27μ, while in *P. Durvillaei* they are quadrate and oblong and about 13–28μ in diameter. The plant represents possibly an undescribed species, but as several poorly understood species have been proposed in the genus and as our material is sterile, we would hardly venture at this time to suggest a new specific name.

Dictyota Vivesii sp. nov.

Densely cespitose, stupose at base, 7–9 cm. high, 135–160μ thick (240μ at base), collapsed and thin on drying, somewhat regularly 3–6 times dichotomous below, the branches then rather closely 3 or 4 times subflabellately or subpinnately dichotomous, sinuses mostly rather acute, margins very entire or slightly un-

dulate; main segments oblong or obcuneate, 3–8 mm. broad, diminishing conspicuously in length and width in the apical subdivisions, the terminal segments mostly 1–2 mm. wide, their dichotomies forming angles of about 45°, the apices obtuse or subacute; surface on drying mostly smooth or slightly and irregularly reticulate in the older parts; cortical cells nearly uniform in size and color, 19–65μ × 11–27μ, 1–3 times longer than broad; interior cells 96–250μ × 55–110μ, very thin-walled and often inconspicuous when viewed through the cortex, the walls perpendicular to the surfaces mostly only 1–2μ thick (10–12μ in basal parts), collapsing on drying; tetrasporangia forming small scattered inconspicuous sori. [PLATE 27.]

La Paz, *Vives 2* (type) and *18e*.

Dictyota Vivesii is perhaps most nearly related to *D. Bartayresiana* Lamour., but cannot well be identified with that West Indian species. It is more cespitose in habit of growth than *D. Bartayresiana*, more stupose at the base, less regularly dichotomous towards the apices, rather broader in its broadest parts and more conspicuously dwindling in width as the ultimate segments are approached, the axils (the upper at least) are more acute and the segments less patent or divaricate, the apices are less acute, and both the cortical and the interior cells are for the most part narrower and the cortical cells overlying the septa and lumina of the interior cells show scarcely any of that differentiation in form and translucency that led J. Agardh to describe *D. Bartayresiana* as "fenestrate"; the walls of the interior that are perpendicular to the surface are remarkably thin, being usually only 1–2μ thick, while those of *D. Bartayresiana* are ordinarily 3–7μ thick; whether wholly as a result of this thinness of the walls, or in part as a result of the treatment the specimens may have received, we do not know, but the interior cells of our dried specimens of *D. Vivesii* are so completely collapsed that they do not at all regain their natural form on being soaked with water, though they revive tolerably well on being treated with a solution of potassium hydrate. The smoothness of most parts of the surface of *D. Vivesii*, in its dried state, may be due in some measure to the presence, in many portions of the thallus, of a layer of small oval diatoms so closely adherent and so evenly disposed that their presence is revealed only by the higher powers of the microscope. The tetraspores of *Dictyota Vivesii* occasionally, as in most other species of the

genus, germinate precociously or while still attached to the thallus, so that the surface appears inconspicuously proliferous here and there.

The only Dictyotas hitherto recognized from the Pacific coast of North America are, so far as we are aware, *Dictyota crenulata* J. Ag. from St. Augustin, Mexico, and *D. Binghamiae* of California. Of these, *D. crenulata* is characterized by strong marginal teeth, which are wholly lacking in *D. Vivesii;* by elongate or lingulate, broadly obtuse or subtruncate terminal segments, which are as broad as any part of the thallus; by a cortex that is for the most part conspicuously fenestrate in the Agardhian sense; by thicker-walled cells; and by a usually reticulate surface when dry.

Dictyota Binghamiae is a coarser, thicker (275–500μ), more regularly dichotomous plant, with segments usually broader and their width better sustained towards the apices; its surface is beautifully reticulate when dry, and under the microscope the cortical cells, in most cases, show very clearly the differentiation in form and translucency that suggested the term "fenestrate" to J. Agardh. The cortex, too, of *D. Binghamiae*, towards the margins and in the older parts, often shows two or more layers of cells,—a character that is presumably responsible for its former identification with *Glossophora Kunthii*. The walls of the interior cells, that is, the walls that are perpendicular to the surface, are very firm and thick (5–30μ).

RHODOPHYCEAE

PORPHYRA LEUCOSTICTA Thuret in Le Jolis, Liste Alg. Mar. Cherbourg 100. 1863

San Felipe Bay, *D. T. MacDougal*, Feb. 1904.

This species, so far as we are aware, has hitherto been attributed, for the Pacific coast of America, only to Monterey Bay, California.* The Gulf of California specimens differ a little in color from most European and eastern American plants, tending rather more to brownish and blue-purple shades.

The thallus is about 40μ thick, surface jelly 8–11μ thick; plants monoecious; antheridia in spots and streaks adjoining sporocarps,

* Hus, H. T. A. Zoe 5: 63. 1900; Proc. California Acad. Sci. III. 2: 202. 1902.

both unmixed with vegetative cells; carpospores 8; spermatia 64; thallus disintegrating and deliquescing when dried specimens are soaked out with fresh water.

Scinaia latifrons sp. nov.

Thallus gelatinous-membranaceous, thin, complanate, 10–16 cm. long, 4–7 times dichotomous, not constricted, the segments 5–12 mm. broad (when dry), axils rather acute and branches somewhat patent, costa obsolete, apices obtuse or shortly and bluntly apiculate: cystocarps 0.17–0.32 mm. in diameter, marginal, mostly confined to areas 1–2 mm. broad measured from the margin; carpospores irregularly ovoid or oblong, 10–22μ long. [PLATE 28 and TEXT FIGURE 1.]

La Paz, *Vives 6, 11a* (type), and *20c.*

The material submitted consists of eight specimens, all of which are amply distinct from *S. furcellata undulata*, with which it grows associated, differing in the much broader thinner flattened membranous thallus and the marginal cystocarps. Though having a pronounced "Halymenioid" habit, the plants have the peculiar and characteristic vegetative structure and cystocarps of *Scinaia*. If aberrant in any particular it is in the absence of any costa or well-defined axile strand that can be clearly recognized even in a cross section, contrasting in this respect with *S. furcellata undulata*, with which it is associated and in which a compact axile strand is very manifest in cross section at least. The thallus of *S. latifrons*, even when sections of the dried material have been treated with potassium hydrate, shows a thickness of only 80–135μ, but it is probable that fresh or liquid-preserved specimens would have a greater thickness. The thallus appears to be the thickest towards the margins, whether the margins bear cystocarps or not. A cross section of the stipe shows a compact medullary mass of filaments with a special axile strand only slightly indicated. The hyaline peripheral cells of the thallus have a height of 27–36μ, averaging considerably higher than in the associated *S. furcellata undulata*. The color of dried specimens of *Scinaia latifrons* is a light brownish rose, while that of *S. furcellata undulata* is a dingy or purplish brown.

Among the described species, varieties, and forms of *Scinaia*, *S. latifrons* is apparently most nearly allied to *S. furcellata* forma

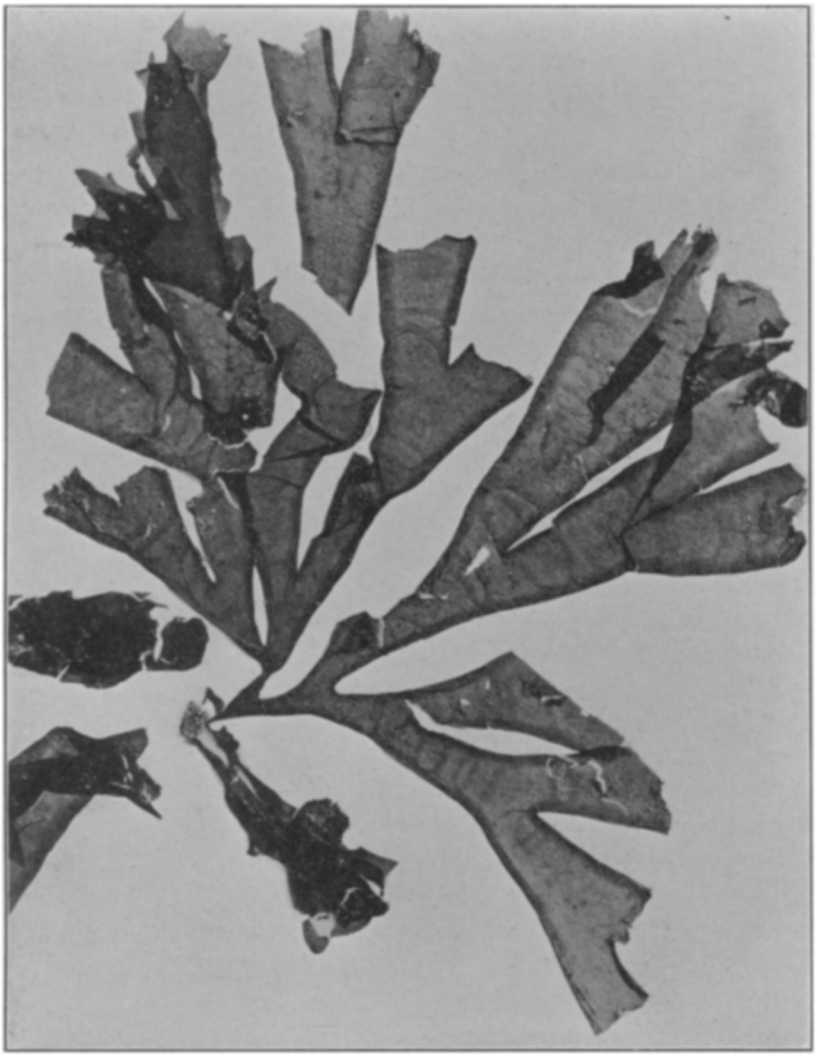


FIGURE 1. *Scinaia latifrons* M. A. Howe

(La Paz, *Vives 11a*), natural size. The dark spots showing near the margins are mostly cystocarps, but those in median parts are due to epiphytic growths. See also PLATE 28, which shows the type specimen somewhat reduced.

complanata Collins (Phyc. Bor.-Am. *836*) from Florida, but in that the segments are only 2 mm. instead of 5–12 mm. broad and the cystocarps are not confined to the margins.

SCINAIA FURCELLATA UNDULATA (Mont.) J. Ag. Sp. Gen. et Ord. Alg. **2**: 422. 1852

Ginnania undulata Mont. Voy. Bonite, Bot. Crypt. 59. *pl. 145. f. 3.* 1844.

La Paz, *Vives 11d* and *20b*.

This differs from *Scinaia latifrons* as noted above.

The two specimens seen have a length of 10–14 cm. and their segments are about 2 mm. wide. The segments are probably terete or nearly so in life, though they do not regain that form on being soaked out.

The specimens appear to agree essentially with those occurring on the coast of California as far north, at least, as Santa Cruz. The peculiarities of the Pacific Coast plant seem insufficient to separate it specifically from *Scinaia furcellata*.

(?) GIGARTINA CHAMISSOI (Mert.) Mont. Voy. Bonite, Bot. Crypt. 71. 1844

San Felipe Bay, *D. T. MacDougal*, Feb. 1904.

The plants are rather small (3–8 cm. long), but are probably nearer to *G. Chamissoi* than to any other described species. The main segments are 2–10 mm. broad and are less regularly pinnate and less elongate than in *G. Chauvinii* (Bory) Mont. The narrower specimens resemble certain broader conditions of *G. Teedii* (Roth) Lamour. The faces of the segments are smooth or sometimes lightly papillate and the only cystocarps seen are marginal. The branching is much more pinnate than in any of the California specimens that we have seen referred to *G. papillata* (Ag.) J. Ag.

Anatheca dichotoma sp. nov.

Thallus cuneate-attenuate at base, subcartilaginous or somewhat gelatinous, reaching a length of 25 cm., mostly 7–11 times dichotomous and with occasional marginal proliferations, segments 6–12 mm. in greatest width, tapering to 1 or 0.5 mm. in the ultimate divisions, 0.66–1.3 mm. thick, axils rounded, branches erecto-patent, apices acuminate, almost terete or conic-terete; the

filamentous or rhizoidal medulla bordered by mostly two irregular series of large cells 240–340μ in maximum diameter in cross section, their walls rather firm, not gelatinizing much in fresh water or glycerin, remaining about 6–15μ thick, the large cells passing somewhat abruptly into the small cells of the outer cortex; the zonate sporangial tetrads irregularly ovoid, 55–85μ in long diameter; other parts not seen. [PLATE 29.]

La Paz, *Vives 7* (type), *11c*, *18b*, and *20a*.

Although our specimens are either sterile or tetrasporic, we have little hesitation in considering this plant a close relative of the one from Whidbey Island, Washington, distributed in the Phycotheca Boreali-Americana, *no. 932*, as "*Anatheca furcata* Setchell & Gardner ms." and afterwards described and figured in Univ. California Publ. Bot. 1: 310. *pl. 23. f. 39; pl. 24. f. 41.* 1903. However, we are at present unwilling to regard them as forms of one species. *Anatheca furcata* reaches a width of 2–3 cm., while *A. dichotoma* is mostly only 1–7 mm. wide; it is once to thrice forked, while *A. dichotoma* is commonly 8–10 times forked; *A. furcata* also has a darker red color, a longer, more attenuate stipe, and its cell walls are more inclined to gelatinize on being soaked out with fresh water, which fact is doubtless responsible for giving specimens a less rigid and cartilaginous habit than those of *Anatheca dichotoma*.

Gracilaria Vivesii sp. nov.

Thallus membranaceous, complanate, regularly and flabellately dichotomous (4 or 5 times forked in specimens seen), attaining a length of 14 cm., 250μ thick in younger parts, becoming 500–700μ below, broadly cuneate or inversely deltoid at base; the lower segments subquadrate or cuneate-oblong, 8–20 mm. broad below, becoming 10–35 mm. broad under the dichotomies; segments of the two ultimate dichotomies considerably narrower, oblong or somewhat linear-oblong, 7–10 mm. wide, diminishing to 4–6 mm. in the terminal; margins entire, axils rounded, dichotomies patent or occasionally somewhat divaricate, apices rounded-obtuse, color a vinous- or coralline-red fading to light greenish pink; medulla composed of two or three irregular series of subglobose, ovoid or somewhat flattened nearly empty cells 50–400μ in diameter, bounded by one or two series of much smaller subglobose or flattened subcortical cells; cortex 1–3-stratose, the surface jelly firm and 13–28μ thick: antheridia beginning as shallow pockets in the cortex, soon becoming more or less confluent and covering a large part of the

thallus surface, mostly, however, bounded by narrow reticulately disposed series of sterile cells. [PLATE 30; PLATE 33, FIGURES 1–5.]

La Paz, *Vives 20e* (type) and *11b*.

No. *20e*, the larger of the two specimens seen, is antheridial and *11b*, the smaller, is sterile. The plants are somewhat Rhodymenioid in habit, but their structure is rather more suggestive of that of plants of J. Agardh's subgenus *Podeum* of *Gracilaria*, though the medullary cells are more nearly empty than is customary in this group. However, the antheridia appear to harmonize much better with those of *Gracilaria*, so far as described, than with the wholly superficial or exserted and uninterruptedly expansive antheridia of *Rhodymenia*. So far as we are aware, the antheridia have been described in only three species of *Gracilaria*, viz., *G. confervoides*,* *G. armata*,† and *G. compressa*.‡

The antheridia of *Gracilaria confervoides* are described and figured as occupying nearly closed pear-shaped cavities, the bases of which penetrate the subcortical layer. Those of *G. Vivesii* are more like shallow saucers, often irregular in outline, and they are confined to the rather thin cortex and are covered only by the hyaline outer walls of what were originally epidermal cells; they seem to agree essentially with the descriptions of the antheridia in *G. armata* and *G. compressa*, and similar antheridia are present in a specimen from Barbados in the herbarium of the New York Botanical Garden, distributed as "*Gracilaria multipartita* J. Ag. fronde latiori" (Vickers, Alg. Barb. *136*).

The two nearest relatives of *Gracilaria Vivesii* are probably *G. Cunninghamii* Farl.§ (J. Ag. Sp. Alg. 3^4: 93. 1901), based upon material from Santa Barbara, California, and *Gracilaria* (?) *peruana* Picc. & Grun., from Paita, Peru. *Gracilaria Vivesii* differs from *G. Cunninghamii* in its brighter red (less brownish) color, in being regularly dichotomous instead of often somewhat tri- or polychotomous, in its less elongate, less cuneate, and broader

* Thuret, in Le Jolis, Liste Alg. Mar. Cherbourg 134. 1863; Thuret & Bornet, Études Phyc. 80–82. *pl. 40. f. 1, 2.* 1878; Buffham, Jour. Quekett Micros. Club II. **5**: 294. *pl. 13. f. 11, 12.* 1893.

† Thuret, Ann. Sci. Nat. IV. **3**: 22. 1855; Thuret & Bornet, loc. cit.

‡ Thuret & Bornet, loc. cit.

§ This specific name appears to have originated through the misreading of a different genitive specific name accompanying a specimen sent to Agardh by Mrs. G. A. Hall.

(20–35 mm. max. *vs.* 10–13 mm.) segments, more patent or subdivaricate branching, and larger more vacuous medullary cells. *Gracilaria* (?) *peruana* Picc. & Grun. was briefly described and thus far appears to be known only from the original collection, from which, through the courtesy of Professor G. B. De-Toni, we have been able to examine a portion of a tetrasporic specimen. *Gracilaria Vivesii* differs from it in being of a coral-red or rose instead of a sordid green or lurid brownish color, in being regularly dichotomous instead of di-polychotomous, in having segments that are subquadrate or cuneate-oblong rather than subcuneate-linear and patent or subdivaricate rather than subparallel, and in having a cortex that is 1–3 instead of 3 or 4 cells thick in the mature parts and whose outer walls are 13–28μ instead of only 4–6μ thick. The medullary cells in *G. peruana* are large and vacuous, much as in *G. Vivesii*, but are even larger, sometimes showing a maximum diameter of 650μ in a cross section of the thallus. The transition from these large medullary cells to the small cells of the cortex is a little less abrupt than in *G. Vivesii*. The thallus of *G. peruana* is rather thicker than that of *G. Vivesii*, attaining a maximum thickness of about 1 mm. in the older parts of the fragment seen; it scarcely adheres to paper.

Rhodymenia peruviana J. Ag. is doubtless deserving of mention in connection with *Gracilaria Vivesii*. The writer's present knowledge of this Peruvian species is based chiefly on Agardh's description and a photograph of the original specimen which has been accessible through the kindness of Professor O. Nordstedt. Its mode of branching and general habit do not suggest the Baja California plant, and Agardh's allusion to sori in connection with the tetrasporangia would seem to indicate that *Rhodymenia peruviana* does not belong in *Gracilaria*. In size and in habit, so far as can be judged from a photograph, *Rhodymenia peruviana* is not very different from *Gracilaria* (?) *peruana*, yet Piccone and Grunow, having before them Agardh's description of the color and consistency of *R. peruviana* and having before them also the cystocarps and scattered tetrasporangia of their own Peruvian plant, were apparently quite right both in considering their plant different from Agardh's and in referring it to the genus *Gracilaria*.

Fauchea Sefferi sp. nov.

Thallus moderately thin (30–80μ) and cartilaginous-membranaceous when dry, cartilaginous and 135–320μ thick when moist, cespitose-ascending(?), dichotomous, mostly 6–11 times forked, spreading 7–12 cm., axils rounded or subacute, segments linear, 1–2.5 mm. wide, nearly uniform in width throughout or slightly wider under the dichotomies, rarely concrescent, margins entire (except for cystocarps), the terminal segments tapering, obtuse or subacute, somewhat divaricate or patent; color a dull brownish red; medullary layer of 2–6 irregular series of large elongate nearly empty cells, these often irregularly compressed and folded, 55–137μ × 22–55μ in cross section (or reaching 240 × 110μ in basal parts), with occasional small interstitial cells, passing rather abruptly to the subcortical layer of 1–3 series of smaller thick-walled cells; cortical layer composed of distinct anticlinal rows of 4–8 series of minute cells, these 3–9μ high, walls of cortical cells soft, gelatinous, and confluent: cystocarps marginal, sessile, nearly spherical, obovoid, or hemispherical, 0.5–0.95 mm. in diameter. [PLATE 31.]

La Paz, *Vives 11e.*

Fauchea Sefferi is in a way intermediate between the Mediterranean *F. repens* (Ag.) Mont. and the Californian and possibly northern *F. laciniata* J. Ag., but is amply distinct from both. From *Fauchea repens* it differs in the evidently non-repent habit of growth, in the thin and less cartilaginous thallus, in the narrower segments (1–2.5 mm. *vs.* 2–8 mm.), in the smaller, more gelatinous-walled, more irregularly compressed and often folded cells of the medulla, in the occurrence of occasional small interstitial cells among the large cells, and in the more globose sessile cystocarps. From *Fauchea laciniata*, *F. Sefferi* differs in the dichotomous instead of palmate-laciniate mode of branching, in having the principal segments narrower (often 1 cm. or more broad in *F. laciniata*) and linear rather than cuneate, in the smaller strictly marginal and non-coronate cystocarps, in the more gelatinous cell walls, the usually more compressed cells of the medulla, etc.

The specimens, dried under pressure, adhere fairly well to paper except in the older parts.

This species is dedicated to the memory of the late Dr. Pehr Olsson-Seffer, editor of the American Review of Tropical Agriculture and professor of botany in the new Mexican University,

whose tragic and much lamented death in connection with the recent civil disturbances in Mexico occurred on April 29, 1911, a few days after he had communicated this and other Lower Californian algæ to the writer for determination.

Fauchea (?) **mollis** sp. nov.

Thallus thin (25–35μ) and membranaceous when dry, soft, lubricous, and 165–350μ thick when moist, cespitose-decumbent, flabellately subdi-trichotomous, the mats 6–9 cm. in diameter, the main segments mostly 5–8 times forked, radiating from a center and more or less overlapping in 2–4 layers, the layers here and there concrescent and coherent chiefly by deflexed more or less specialized originally marginal lobes, axils rounded and the segments again approximate or often overlapping; segments short-oblong, subquadrate, or occasionally subcuneate, 2–15 mm. broad, mostly as broad as long, margins entire, the terminal segments 2–5 mm. broad, rounded-truncate or bi-trifid-retuse; color a dull brownish red or greenish rose; medullary layer of 2 (3) series of large nearly empty cells, these mostly oval or elliptical and 82–275μ × 68–137μ in cross section, rounded-hexagonal or rounded-oblong when viewed through the cortex, without smaller interstitial cells, passing abruptly to the thin subcortical layer of 1–4 series of much smaller cells; cortical layer of mostly 2 series of minute cells 5–9μ high, anticlinal filaments scarcely recognizable unless at margins, walls of cortical cells soft, gelatinous, confluent, and hardly visible when soaked out, other parts wanting. [PLATE 32; PLATE 33, FIGURE 6.]

La Paz, *Vives 18a* (type) and *11f*.

The specimens described above are apparently sterile, but in habit and vegetative structure they have so much in common with *Fauchea* that we can feel little doubt as to their generic affinities. *Fauchea (?) mollis* is perhaps most nearly allied to the Australian *F. nitophylloides*,* but the segments of the Baja California plant are short-oblong or subquadrate instead of linear, the thallus is much thicker (165–250μ *vs.* 65–85μ) and much more gelatinous, so that it adheres very firmly to paper, the medullary cells are much larger (82–275μ *vs.* 27–68μ, long diameter in cross section) the walls of the cortical cells are gelatinous and confluent when soaked out instead of firm and distinct, and the color is a dull brownish red or greenish pink instead of scarlet.

* For the privilege of examining authentic material of this species we are indebted to Professor W. G. Farlow and Mr. F. S. Collins.

J. Agardh has remarked that in habit *Fauchea nitophylloides* suggests *Rhodophyllis bifida* or narrow specimens of *Nitophyllum ocellatum*. It may be said that *F.* (*?*) *mollis* suggests the broader conditions of these species. In structure *F.* (*?*) *mollis* is not very different from certain species of *Gracilaria* of J. Agardh's subgenus *Podeum*, section *Rhodymenioideae*, but the cell walls and the frond as a whole are softer and more gelatinous than in any *Gracilaria* that we are familiar with and the large cells of the medulla are more hyaline and vacuous than is customary in that section of *Gracilaria*.

LAURENCIA PANICULATA (Ag.) J. Ag. Sp. Gen. et Ord. Alg. **2**: 755. 1852

Chondria obtusa paniculata Ag. Sp. Alg. 343. 1822.

La Paz, *Vives 22*.

Plants rather more slender and ultimate branchlets more elongate than in specimens from La Jolla, California, distributed in Phyc. Bor.-Am., *no. 1093*.

The current name for the species is used here provisionally, though the specific name appears to depend for its priority on its publication as a varietal name, which violates all of the current codes of nomenclature. Two older names in the specific category that are commonly cited as synomyms are *Laurencia patentiramea* (Mont.) Kütz. and *L. glandulifera* Kütz., but the older of these, *L. patentiramea*, according to Montagne's original figure, does not apply very accurately to our Baja California plant and there are possibly grounds for doubting the alleged synonymy. The elongate ultimate branchlets of the Vives plant are rather suggestive of those figured by Kützing (Tab. Phyc. **15**: *pl. 63. f. a, b.* 1863) for his *L. paniculata*, but they are not distichous or pinnate. Kützing's *Laurencia paniculata*, which, by the way, antedates J. Agardh's, is referred to *L. pinnatifida* by De-Toni; J. Agardh first cited it as a doubtful synonym under his own *L. paniculata*, but afterward (op. cit. **3**: 651) omitted to refer to it.

POLYSIPHONIA CALIFORNICA Harv. Ner. Bor.-Am. **2**: 48. 1853

San Felipe Bay, *D. T. MacDougal*, Feb. 1904.

The specimens are a little more luxuriant than Harvey's type

from "Golden Gate, California," but they agree closely in habit, color, and structure.

The pericentral siphons are usually ten in number but vary from nine to eleven. The basal internodes are 6–10 times as long as wide. Simple colorless monosiphonous "leaves" are abundant at the tips.

CENTROCERAS CLAVULATUM (Ag.) Mont. in Durieu, Fl. Algérie 1: 140. 1846

Ceramium clavulatum Ag. in Kunth, Syn. Pl. Aeq. 1: 2. 1822.

La Paz, in the herbarium of the New York Botanical Garden, ex herb. C. L. Anderson, collector unknown.

The fragmentary specimen is from a stouter and more spiny plant than the original *Ceramium clavulatum* Ag., which was brought from Callao, Peru, by Humboldt. It also has shorter internodes and more forcipate apices. It suggests Kützing's figures of his *Centroceras oxyacanthum*, drawn from a South African specimen, though originally described from Cuban material; however, the spines are less conspicuous than in *C. oxyacanthum* and are not much in evidence, except at the apices.

The type of *C. clavulatum* in herb. Agardh is a slender plant with rather strict dichotomies, the tuft standing about 3.5 cm. high. The filaments are 85–110μ in diameter; the internodes are 320–510μ long below, becoming about 80–100μ long under the terminal dichotomy; the apices are incurved only in the youngest growth stages and are scarcely forcipate in the usual sense of the term; no lateral innovations were noticed; the spines are few, small, erect or incurved, and very inconspicuous, consisting of one or two cells and rarely reaching a length of 40μ. Kützing was doubtless right in suspecting* that the original *Ceramium clavulatum* belonged with his own *Centroceras cryptacanthum*, of which his var. β. *longiarticulatum* came from the coast of Peru, the type region of *Ceramium clavulatum* Ag.

Halymenia actinophysa sp. nov.

Thallus plane, sessile (?), very thin (70–130μ), gelatinous-membranous, elliptic-obovate or irregularly orbicular, attaining a length of 30 cm. or more and width of 20 cm., occasionally and

* Linnaea 15: 742, 743. 1841.

irregularly perforate, the margins entire or sinuate or here and there irregularly dentate or lacerate, the surface nitent, the color mostly a light greenish rose; medullary filaments sparingly laterally or subdichotomously branched, 14–24μ in diameter, gradually enlarging distally (often becoming 27–40μ in older parts) and each terminated by a subglobose capituliform cell, this 45–95μ in diameter and emitting radially or stellately 3–14 (usually 6 or 7) rather straight and rigid branches, these connecting with one or two series of similar or more flattened radiately branched and reticulately joined subcortical cells, succeeded by one or two series of smaller subglobose or flattened anastomosing subcortical cells and the monostromatic or occasionally distromatic cortex; the cortical cells subglobose, obovoid, or more often flattened in the plane of the surface, 5–13μ in diameter, usually 3–6 from each subjacent cell: other parts unknown. [PLATE 34.]

La Paz, *Vives 20d.*

The three specimens on which the foregoing description is based are evidently fragments and some of the details of the diagnosis, especially as regards the size and form of the thallus, may require modification when more material is available. The specimens, also, appear to be sterile, but their structural characters are such that we feel little hesitation in referring them to the *Hymenopsis* section of *Halymenia*—the section that includes the European and Mediterranean *Halymenia latifolia* Crouan and *H. ulvoidea* Zanard., and possibly also the American *H. floridana* J. Ag. *Halymenia latifolia* has a firmer, relatively narrower, less nitent thallus of more definite regular form and a well-defined cuneate stipe; it is not certain that the holdfast is present in any of the Baja California fragments, but what appears to be a subtruncate or slightly cordate base in one of them suggests that the plant is sessile. *H. latifolia* has radially branched cells in the subcortex that sometimes resemble the smaller of the radiate or stellate subcortical cells of *H. actinophysa*, but they are (in a Brest specimen) only 25–30μ in diameter, have usually but 3–5 branches, and are nearly always much flattened; if these radiate cells in *H. latifolia* often in form suggest Asteroid or Ophiuroid "star-fishes," the corresponding cells in *H. actinophysa* in a detached condition may remind one of the pollen grains of certain Malvaceae or the "morning-star" maces of the 15th century.

The limits of *Halymenia floridana* J. Ag. are imperfectly under-

stood and it is probable that the name has been applied to more than one thing, but, in any event, it has, as a rule, a considerably thicker, less gelatinous thallus than *H. actinophysa*, and is less nitent when dry. In a cystocarpic specimen from Florida in herb. Agardh, communicated by Mrs. Floretta C. Curtiss, the medullary filaments are 8–13μ in diameter and have dense granular contents, the subcortical layer consists of 1–3 series of ovoid or subglobose densely granular cells, mostly somewhat flattened in the plane of the thallus; conspicuously capitate endings for the medullary filaments are scarcely found, though the subcortical cells anastomose and are sometimes inconspicuously 3–6-radiate; it should be said, however, that there are frequent large ganglioid or irregularly stellate cells or filaments which have more homogeneous contents, and whose branches make their way freely among the ordinary vegetative filaments; these we take to be the sporogenous filaments. But in thicker, more gelatinous plants that have been referred to *H. floridana*, with more vacuous, more flexuous, and commonly a little larger medullary filaments (such, for example, as Phyc. Bor.-Am. *749a*, *b*, and *c*), one often finds stellate vegetative ganglia in the medulla and finds also the medullary filaments terminating in the subcortex in a subglobose radiately branched cell, but this rarely exceeds 30μ in diameter and its branches very rarely, if ever, exceed six in number.

Of *Halymenia ulvoidea* Zan. and *H. coccinea* Ardiss. we have been able to examine no authentic specimens, but *H. ulvoidea* is described and figured as having a dentate-ciliate margin and *H. coccinea*, which De-Toni hints may be *Callymenia Requienii*, is said to have a lamina only 1–2 cm. wide.

Halymenia actinophysa is in some respects rather suggestive of *Aeodes nitidissima* J. Ag., an apparently original cystocarpic specimen of which, collected by Berggren at Tauranga, New Zealand, and sent out by J. Agardh, we have been able to examine through the courtesy of Professor Farlow. But *H. actinophysa* is a thinner, softer, more gelatinous plant (the thallus of *Aeodes nitidissima* is about 240μ thick) and is quite different in vegetative structure. In *Aeodes nitidissima* the medullary filaments on reaching the subcortex send out usually 3 branches in a somewhat verticillate manner, but there is very rarely any tendency to a capitate enlarge-

ment, in fact, the diameter of the filament commonly suffers a slight diminution at the nodal point; the cells of the subcortex have substellate anastomosing branches, but the cells are very small in comparison with the corresponding cells of *Halymenia actinophysa* and they rarely have more than 3 or 4 branches. The cortex of the New Zealand *Aeodes nitidissima* consists of distinctly anticlinal moniliform filaments of which the ultimate peripheral cells are, as described by Agardh, decidedly narrower than the subjacent cells ("exterioribus conspicue angustatis"); these cells are only 1–3μ in diameter when viewed from the surface, but in a cross section of the thallus are seen to be about twice as high as broad. It may be remarked that in the specimens from Whidbey Island, Washington, distributed in the Phycotheca Boreali-Americana (*no. 946*) as *Aeodes nitidissima* J. Ag., the cells of the cortex may hardly be described as being in distinct anticlinal rows, and the ultimate peripheral cells instead of being conspicuously narrower than those immediately subjacent are of equal width or even broader and have 2–4 times the diameter of the corresponding cells in the New Zealand plant.

The dried specimens of *Halymenia actinophysa* adhere very firmly and intimately to paper. The cell walls are so gelatinous and translucent that one gets little idea of the real structure of the thallus by examining an ordinary section in water or in water and glycerin—at least until one has learned otherwise what to expect and look for; but by staining sections or fragments with haematoxylin and afterwards swelling out the more or less collapsed cells by applying a little potassium hydrate or picric acid, the relations of the parts become manifest.

NEW YORK BOTANICAL GARDEN.

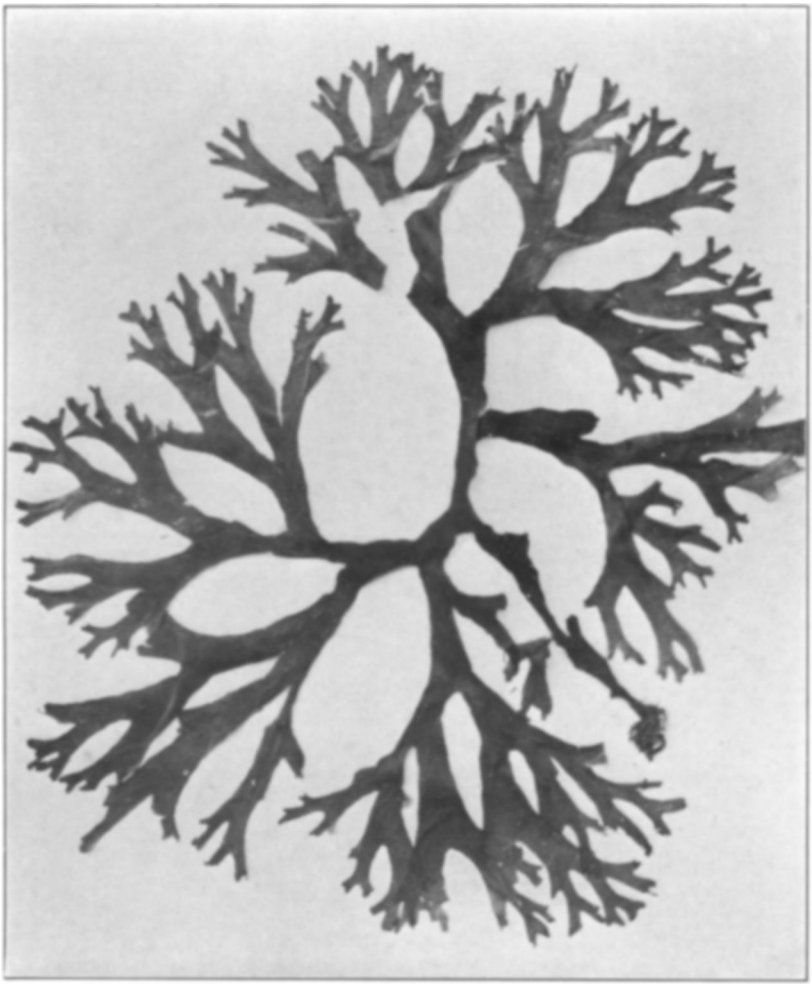
Explanation of plates 27-34

PLATE 27. *Dictyota Vivesii*

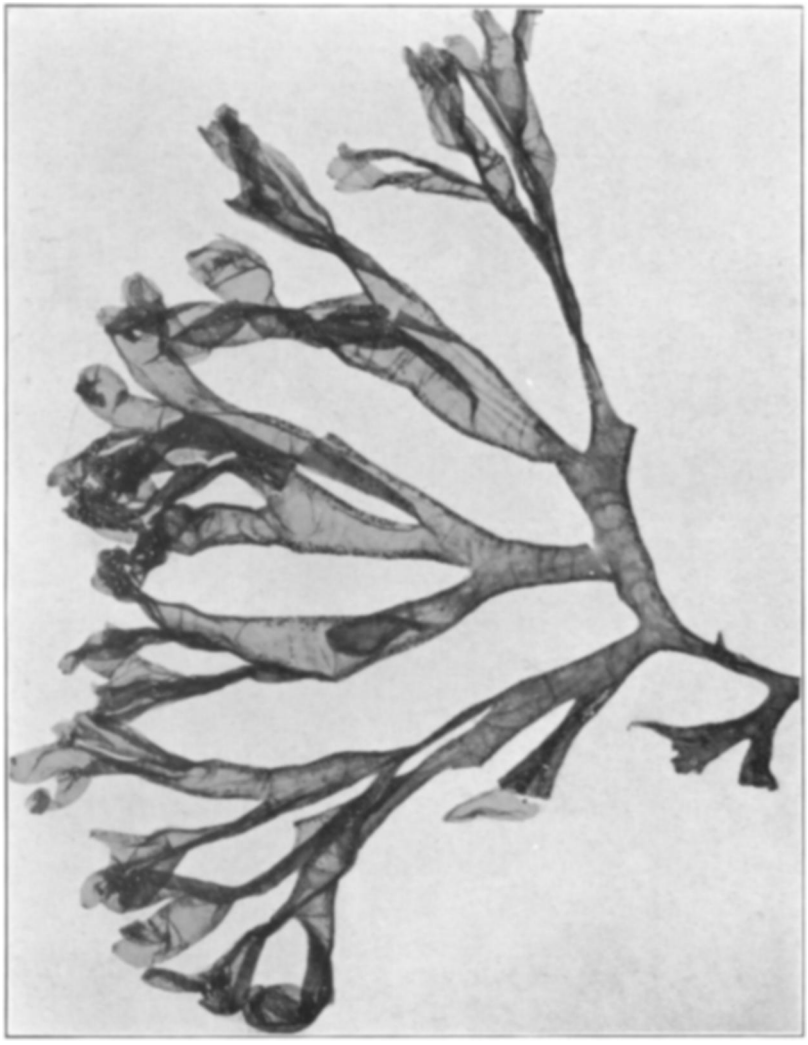
A photograph of a portion of the type specimen (La Paz, *Vives 2*), natural size. The stipe is shown towards the lower right-hand corner.

PLATE 28. *Scinaia latifrons*

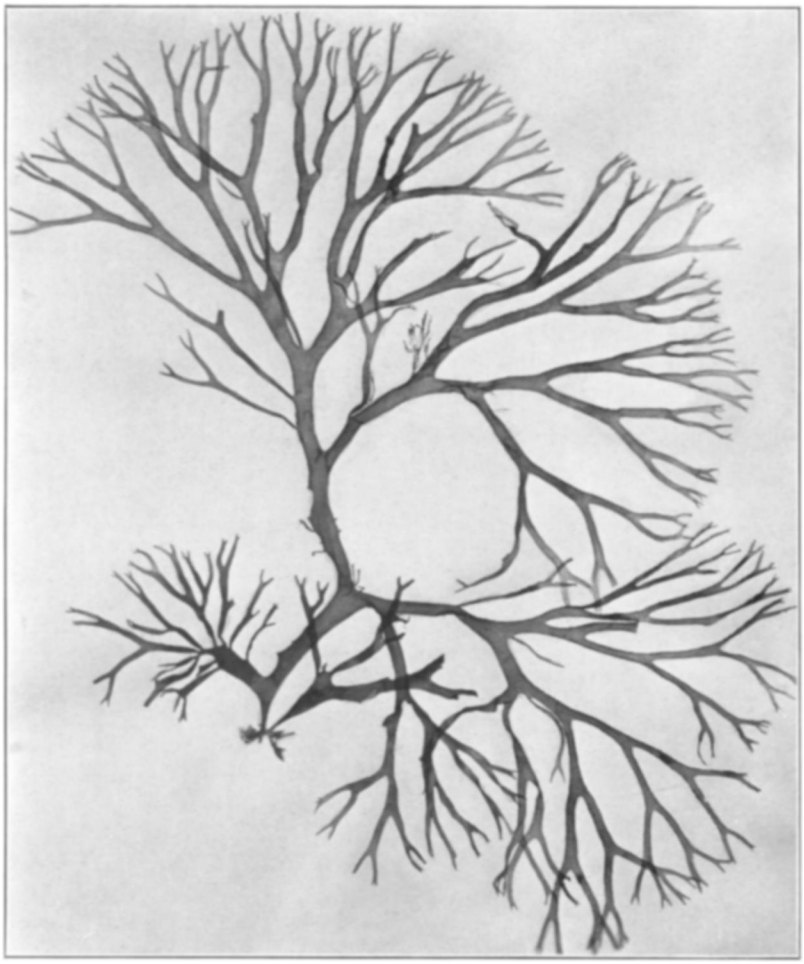
A photograph of a portion of the type specimen (La Paz, *Vives 11a*), nine tenths of the natural size. The cystocarps are visible near the margins in the median portions. See also FIGURE 1 (in text), which shows a better mounted, though mutilated specimen.



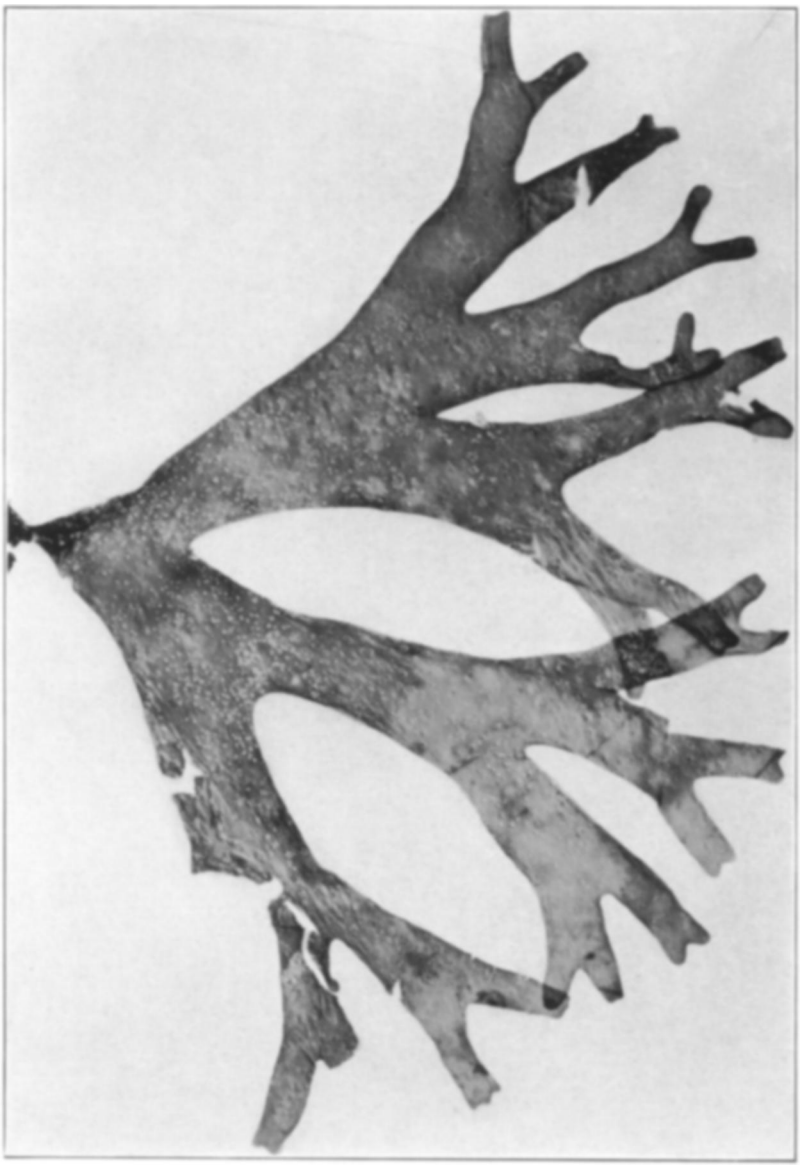
DICTYOTA VIVESII M. A. HOWE



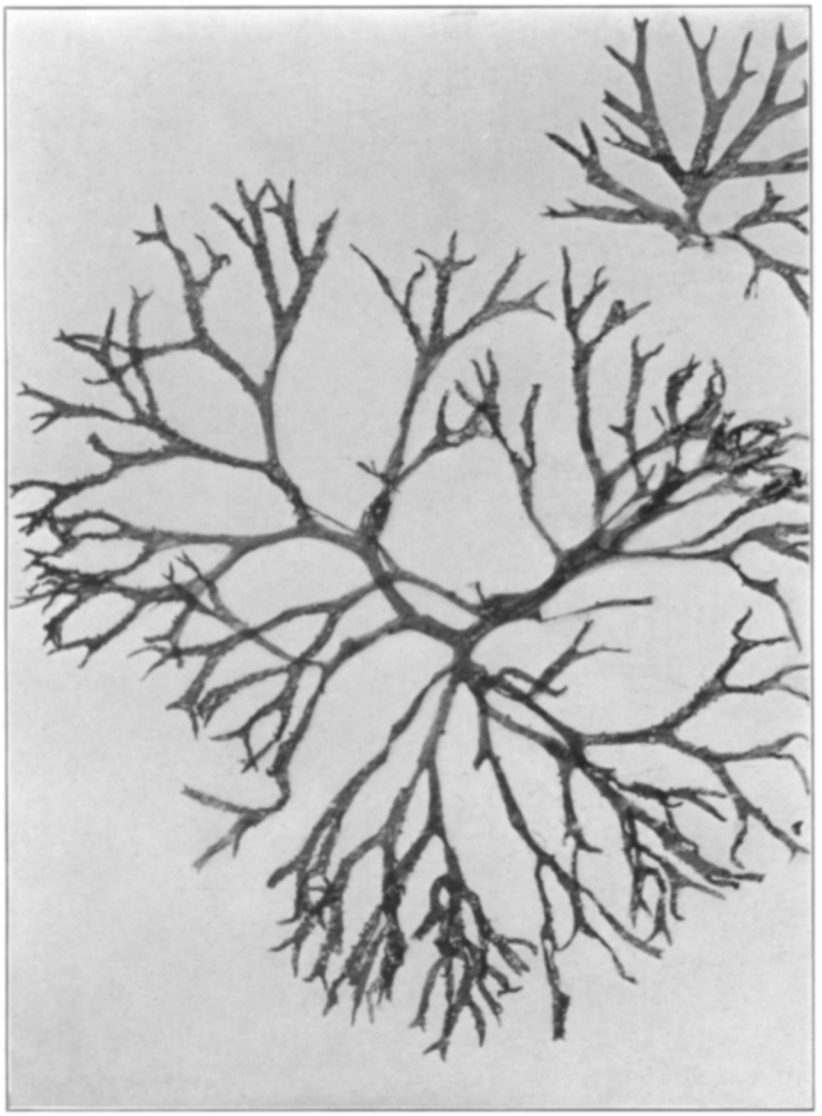
SCINAIA LATIFRONS M. A. HOWE



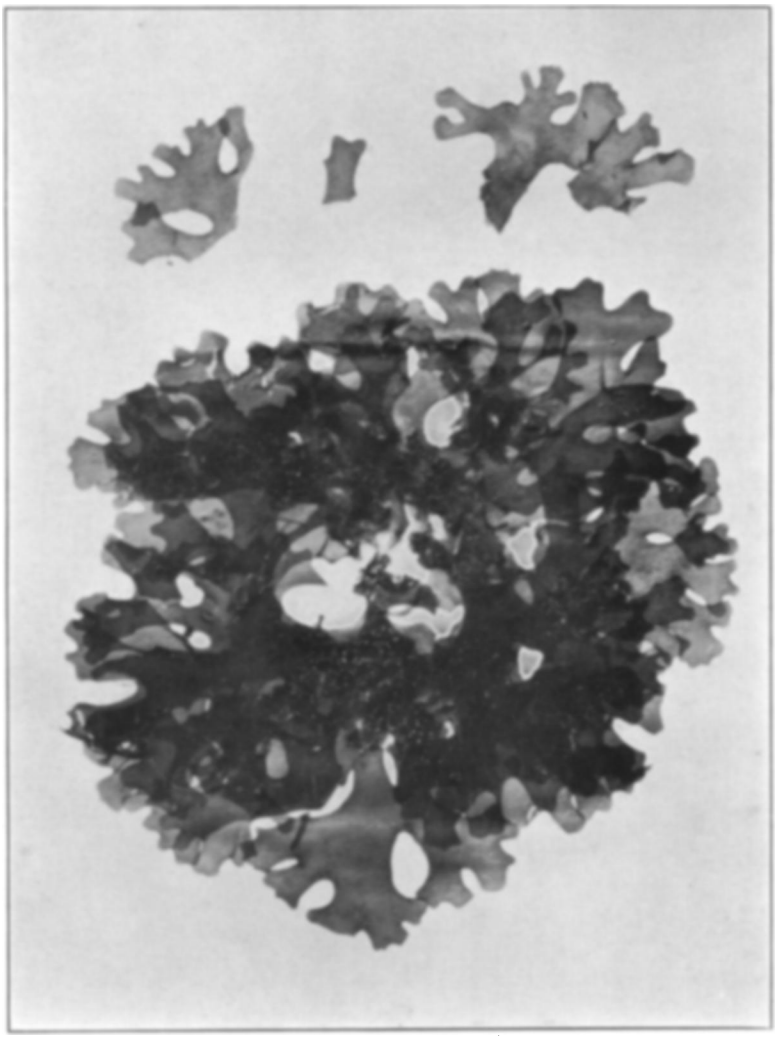
ANATHECA DICHOTOMA M. A. HOWE



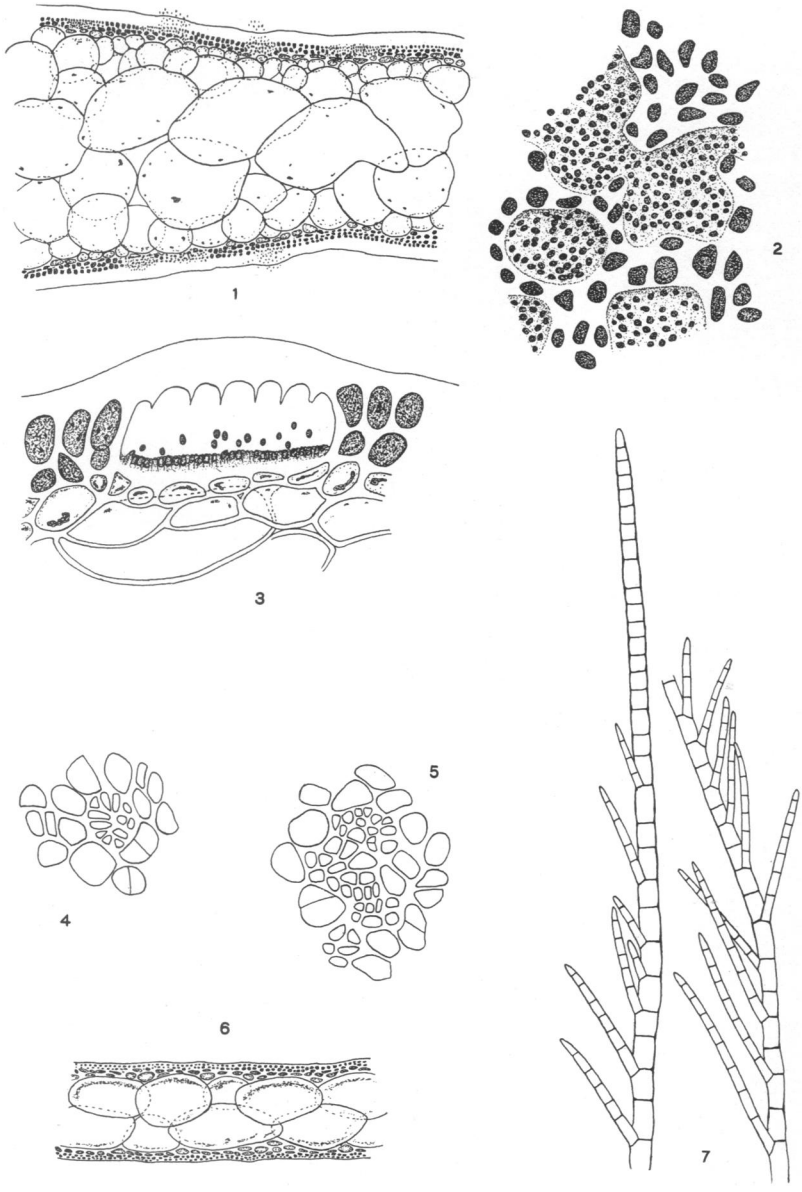
GRACILARIA VIVESII M. A. HOWE



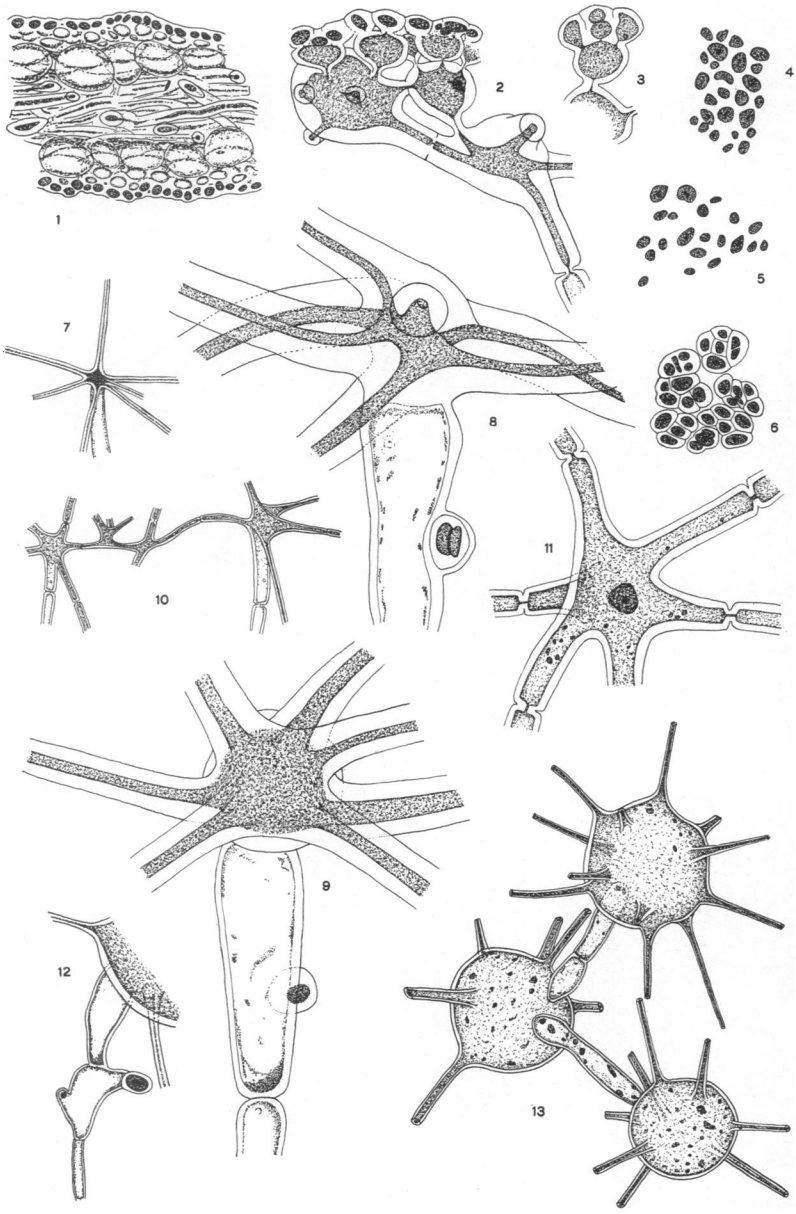
FAUCHEA SEFFERI M. A. HOWE



FAUCHEA (?) MOLLIS M. A. HOWE



1–5. GRACILARIA VIVESII M. A. HOWE
6. FAUCHEA (?) MOLLIS M. A. HOWE
7. CLADOPHORA MACDOUGALII M. A. HOWE



HALYMENIA ACTINOPHYSA M. A. HOWE

PLATE 29. *Anatheca dichotoma*

A photograph of a portion of the type specimen (La Paz, *Vives 7*), a little more than one third of the natural size.

PLATE 30. *Gracilaria Vivesii*

A photograph of a portion of the type specimen (La Paz, *Vives 20e*), about four fifths of the natural size.

PLATE 31. *Fauchea Sefferi*

A photograph of portions of the type specimen (La Paz, *Vives 11e*), natural size, showing marginal cystocarps, etc.

PLATE 32. *Fauchea* (?) *mollis*

A photograph of portions of the type specimen (La Paz, *Vives 18a*), natural size.

PLATE 33

1-5. *Gracilaria Vivesii*

1. A cross section of the thallus of an antheridial plant.

2. Surface of antheridial plant. The figure was drawn from a fragment soaked out in water and mounted in glycerin, in which medium the boundaries of the gelatinous walls of the vegetative cells cannot be seen with sufficient distinctness to be drawn accurately. In this mature condition of the antheridia, the gelatinous outer wall shown in FIG. 3 as covering the antheridium has mostly dissolved away and the spermatia occupy shallow cavities in the cortex.

3. A vertical section through an antheridium, which appears to arise through the transformation of the two outer layers of cortical cells.

4, 5. Young antheridia and adjacent vegetative cells in surface view.

FIGURE 1 is enlarged 57 diameters; 2–5, 345 diameters; all from the type specimen (*Vives 20e*).

6. *Fauchea* (?) *mollis*

A cross section through the thallus, enlarged 57 diameters.

7. *Cladophora MacDougalii*

An apical portion of one filament and a fragment near the apex of another, enlarged 11 diameters.

PLATE 34. *Halymenia actinophysa*

1. A cross section of the thallus, partially diagrammatic. The figure was drawn from dried material soaked out in water and mounted in glycerin, under which treatment the outlines of the various structural elements, particularly of the large cells of the subcortex, are less distinctly visible than indicated in the figure. The larger cells are often so flattened, collapsed, or translucent that the medulla commonly appears relatively broader and the cortex thinner than represented; and the medulla is often less compact.

2. A fragment from the cortex and subcortex, showing anastomoses of the subcortical cells, etc.

3. Another fragment, showing other forms of cortical cells and their relations to the subcortex.

4. Cortical cells in surface view; from a glycerin mount, in which the boundaries of the cell walls are too indistinct to be drawn with accuracy.

5. A similar view in an older part of the thallus, with the cell walls more swollen and the protoplasts more widely separated.

6. Cortical cells in surface view, after staining with haematoxylin and treatment with KOH. The grouping of the cells indicates more or less clearly their relations to the subcortical cells; e. g., the upper group of six cells crowns a single subcortical cell.

7. A stellate or radiate termination of one of the medullary filaments.

8, 9. Capitate and stellately branched terminations of the medullary filaments in more detail. The pedicel in each figure shows the beginning of a lateral branch.

10. Cells of the subcortex, showing connections and mode of branching.

11. A somewhat flattened branched cell of a form that occurs in the subcortex about halfway between the cortex and the capitate terminations of the medullary filaments.

12. A portion of a medullary filament terminating in the subcortex and showing the beginnings of two lateral branches. The terminal cell of such branches carries a dense and conspicuous protoplast.

13. Stellately branched subcortical cells from a young part of the thallus, one of them showing 13 branches. These branches connect with other similar, but mostly smaller and more peripheral cells, from which they have been detached.

FIGURES 1–6, 8, 9, 11, and 12 are enlarged 276 diameters; 7 and 10, 46 diameters; 13, 244 diameters. The sections and fragments from which figures 2, 3, 6, 7–10, 12, and 13 were drawn were stained with haematoxylin and then swollen out with a solution of KOH; in figures 2, 3, 8, and 9, the thickness of the gelatinous cell walls and probably the dimensions of the parts in general have been somewhat exaggerated by an excess of KOH. FIGURE 11 was drawn from material that had been stained with picric-nigrosin.